

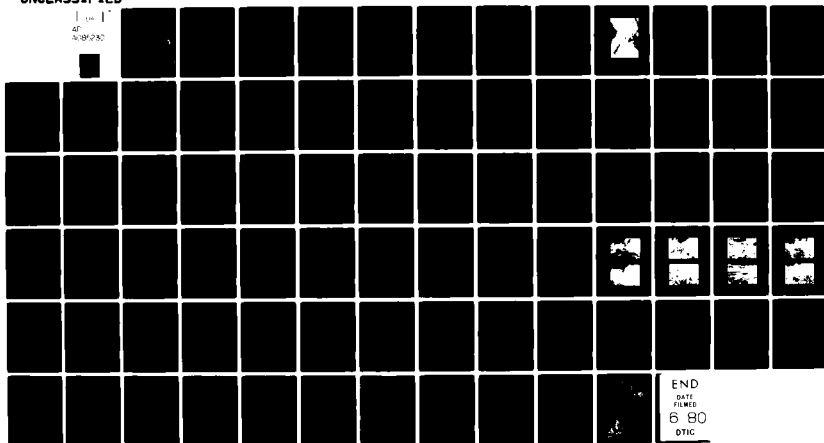
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NATIONAL DAM INSPECTION PROGRAM. WANAMIE DAM (NDI ID NUMBER PA---ETC(U)  
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SUSQUEHANNA RIVER BASIN  
WANAMIE RUN, LUZERNE COUNTY

PENNSYLVANIA

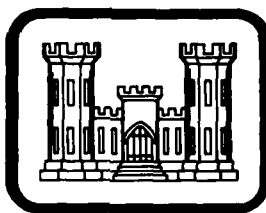
WANAMIE DAM

NDI ID NO. PA-00552  
DER ID NO. 40-21

LEVEL

PENNSYLVANIA GAS AND WATER COMPANY

PHASE I INSPECTION REPORT  
NATIONAL DAM INSPECTION PROGRAM



Prepared by  
GANNETT FLEMING CORDDRY AND CARPENTER, INC.  
Consulting Engineers  
Harrisburg, Pennsylvania 17105

For  
DEPARTMENT OF THE ARMY  
Baltimore District, Corps of Engineers  
Baltimore, Maryland 21203

APRIL 1980

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SUSQUEHANNA RIVER BASIN,  
WANAMIE RUN, LUZERNE COUNTY

PENNSYLVANIA.

6) National Dam Inspection Program.  
WANAMIE DAM

NDI ID # PA-00552  
DER ID # 40-21

PENNSYLVANIA GAS AND WATER COMPANY

PHASE I INSPECTION REPORT  
NATIONAL DAM INSPECTION PROGRAM

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J.E

## PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

SUSQUEHANNA RIVER BASIN  
WANAMIE RUN, LUZERNE COUNTY

PENNSYLVANIA

WANAMIE DAM

NDI ID No. PA-00552  
DER ID No. 40-21

PENNSYLVANIA GAS AND WATER COMPANY

PHASE I INSPECTION REPORT  
NATIONAL DAM INSPECTION PROGRAM

APRIL 1980

CONTENTS

<u>Description</u>	<u>Page</u>
SECTION 1 - Project Information . . . . .	1
SECTION 2 - Engineering Data. . . . .	6
SECTION 3 - Visual Inspection . . . . .	8
SECTION 4 - Operational Procedures. . . . .	10
SECTION 5 - Hydrology and Hydraulics. . . . .	11
SECTION 6 - Structural Stability. . . . .	14
SECTION 7 - Assessment, Recommendations, and Proposed Remedial Measures. . . . .	17

APPENDICES

Appendix

Title

A	Checklist - Engineering Data.
B	Checklist - Visual Inspection.
C	Photographs.
D	Hydrology and Hydraulics.
E	Plates.
F	Geology.

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PHASE I INSPECTION REPORT  
NATIONAL DAM INSPECTION PROGRAM

BRIEF ASSESSMENT OF GENERAL CONDITION

AND

RECOMMENDED ACTION

Name of Dam: Wanamie Dam  
NDI ID No. PA-00552  
DER ID No. 40-21

Size: Small (26 feet high; 114 acre-feet  
existing conditions)

Hazard  
Classification: High

Owner: Pennsylvania Gas and Water Company  
J. Glenn Gooch, President  
39 Public Square  
Wilkes-Barre, PA 18711

State Located: Pennsylvania

County Located: Luzerne

Stream: Wanamie Run

Date of Inspection: 25 October 1979

➤ Based on available records, visual inspection, calculations, past operational performance, and consideration of the existing normal pool level, Wanamie Dam is judged to be in fair condition. The existing spillway is a gorge that was eroded when the spillway washed out in 1955. The spillway can pass the Probable Maximum Flood (PMF), which is the Spillway Design Flood (SDF), with 7.9 feet of freeboard. Based on the size and hazard classification of the dam, the recommended SDF varies between the 1/2 PMF and the PMF. The selected SDF is based on the criteria and the downstream conditions. The pool level at maximum PMF level is 5.2 feet below the normal pool level that existed prior to ➤

1955. The spillway capacity is rated as adequate. This rating is dependent upon removal of the remains of the timber structure in the spillway.

The only significant stability problem that exists at the embankment is a bulge near the left abutment of the embankment.

The Owner presently has no intention of returning the dam to its design condition because there is no present requirement for increased water supply storage at the dam. There are no functional emergency drawdown facilities at the dam. Maintenance of the dam is inadequate. ←

The following investigations and remedial measures are recommended to be undertaken by the Owner, in approximate order of priority, immediately:

(1) Remove the remains of the timber structure from the spillway.

(2) Remove trees and brush on and near the embankment. Upon removal of brush and trees, the embankment should be inspected for bulges, cracks, and other signs of distress. Take appropriate action as required.

(3) Institute a monitoring program at the dam, such that the bulge is monitored with survey instruments or other monitoring equipment. If further movement is noted, provide remedial measures.

(4) Provide operational emergency drawdown facilities at the dam and ensure that there are provisions for upstream closure for all pipes through the embankment.

(5) As part of the maintenance and inspection program recommended below, fill burrowing animal holes and visually monitor seepage, the brush in the spillway, and the minor erosion on the earthfill.

All investigations and monitoring programs should be supervised by a professional engineer experienced in the design and construction of dams. Tree removal should be performed under the guidance of a professional engineer.

In addition, the Owner should institute the following operational and maintenance procedures:

(1) Develop a detailed emergency operation and warning system for Wanamie Dam.

(2) During periods of unusually heavy rains, provide round-the-clock surveillance of Wanamie Dam.

(3) When warnings of a storm of major proportions are given by the National Weather Service, the Owner should activate his emergency operation and warning system.

(4) Institute an inspection program such that the dam is visited frequently. As presently required by the Commonwealth, the inspection program should include a formal annual inspection by a professional engineer experienced in the design and construction of dams. Utilize the inspection results to determine if remedial measures are necessary.

(5) Institute a maintenance program so that all features of the dam are properly maintained.

Should the Owner change his intentions and decide to return the dam closer to the design condition, such that the existing normal pool condition is raised, then the internal dimensions of the dry masonry, the foundation conditions, and the zoning of the earthfill should be investigated and formal stability analyses performed.




WANAMIE DAM

Submitted by:

GANNETT FLEMING CORDDRY  
AND CARPENTER, INC.




  
FREDERICK FUTCHKO  
Project Manager, Dam Section

Date: 2 May 1980

Approved by:

DEPARTMENT OF THE ARMY  
BALTIMORE DISTRICT, CORPS OF ENGINEERS

  
JAMES W. PECK  
Colonel, Corps of Engineers  
District Engineer

Date: 16 May 1980

WANAMIE DAM



Overview

SUSQUEHANNA RIVER BASIN  
WANAMIE RUN, LUZERNE COUNTY

PENNSYLVANIA

WANAMIE DAM

NDI ID No. PA-00552  
DER ID No. 40-21

PENNSYLVANIA GAS AND WATER COMPANY  
PHASE I INSPECTION REPORT  
NATIONAL DAM INSPECTION PROGRAM

APRIL 1980

SECTION 1  
PROJECT INFORMATION

1.1 General.

a. Authority. The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose. The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. Wanamie Dam is an earthfill embankment with a dry stone masonry downstream section. The embankment is 255 feet long and 26 feet high at maximum section.

The spillway is located 400 feet to the right of the embankment. A natural knoll separates the embankment and the spillway. The spillway is a natural gorge at the site of a spillway structure that washed out in 1955. The normal pool level is about 11 feet below the top of the embankment. Hereafter, references to the spillway refer to the gorge and its hydraulic properties except as otherwise noted.

There are no functional emergency drawdown facilities at the dam. A dry stone masonry structure at the downstream toe of the embankment has a valve for the water supply line that extends from the dam. Reportedly, the structure once contained a valve for an emergency drawdown outlet. The various features of the dam are shown on the Photographs in Appendix C and on the Plates in Appendix E. A description of the geology is included in Appendix F.

b. Location. Wanamie Dam is located on Wanamie Run in Newport Township, Luzerne County, Pennsylvania, approximately 0.8 mile southeast of Wanamie, Pennsylvania. Wanamie Dam is shown on the 1969 photorevision to USGS Quadrangle, Nanticoke, Pennsylvania at latitude N 41° 10' 00" and longitude W 76° 01' 30". A location map is shown on Plate E-1.

c. Size Classification. Small (26 feet high, 114 acre-feet, existing conditions).

d. Hazard Classification. High hazard. Downstream conditions indicate that a high hazard classification is warranted for Wanamie Dam (Paragraphs 3.1e and 5.1c (5)).

e. Ownership. Pennsylvania Gas and Water Company, J. Glenn Gooch, President, 39 Public Square, Wilkes-Barre, Pennsylvania 18711

f. Purpose of Dam. Water Supply.

g. Design and Construction History. Wanamie Dam was constructed about 1850 by the Lehigh Navigation Company. The dam was originally an earthfill embankment. In 1884, the Hanover Water Company employed John A. Schmitt, a contractor from Wilkes-Barre, to raise the dam about 8 feet and construct a dry stone masonry wall on the downstream side of the embankment. The Spring Brook Water Supply Company acquired the dam sometime between 1884 and 1914, when the Pennsylvania Water Supply Commission (PWSC) inspected the dam and prepared a report for it. The dam had a timber chute spillway in 1914.

The spillway washed out in 1933. In the same year, Thomas A. Wiggin, a consulting engineer of New York City, prepared a design for a similar timber chute to replace the washed out spillway. The new chute was constructed by the Owner shortly thereafter.

In August 1955, the spillway washed out again. In August 1956, Mr. Wiggin prepared a report concerning the spillway. He concluded that the existing gorge, at the site of the washed out spillway, would function adequately as a spillway and would not be a hazard to the dam. Apparently this report was not submitted to the Commonwealth.

Conditions at the spillway were first brought to the attention of the Commonwealth in 1964, during one of the periodic inspections by the Commonwealth. They contacted the Owner and asked what was intended for the dam. In October 1972, the Commonwealth insisted that they be informed what the Owner intended for the dam. The Owner responded that "we will breach Wanamie Reservoir to an extent sufficient enough to insure that there is no possibility of danger to anyone in case of flood." The Commonwealth approved this in January 1973 and requested that they be notified before the dam was breached.

The dam is apparently in the same condition as it was in 1972. The Owner lists the dam as "not in active service" with the Public Utility Commission. At present, the dam serves as water supply solely for a newly-developed coal mining operation near the community of Wanamie. Anticipated demand, which would occur only during the summer, is 0.3 mgd. The Owner stated that he does not intend to return the dam to its design condition.

h. Normal Operational Procedure. The pool is maintained at the spillway crest level with excess inflow discharging over the spillway. There is no functional outlet works at the dam. Spillway discharge flows downstream in Wanamie Run to the confluence with the South Branch of Newport Creek.

1.3 Pertinent Data. (existing conditions except as noted.)

a. <u>Drainage Area.</u> (square miles)	1.1
---	-----

b.	<u>Discharge at Damsite.</u> (cfs.)	
	Maximum known flood at damsite	Unknown.
	Outlet works at maximum pool elevation	Not functional
	Spillway capacity at maximum pool elevation	7,840
c.	<u>Elevation.</u> (feet above msl).	
	Top of dam	900.2
	Maximum pool	900.2
	Normal pool (spillway crest-see text).	888.8
	Upstream invert outlet works	See Section 5.
	Downstream invert outlet works	See Section 5.
	Streambed at toe of dam	874.0
d.	<u>Reservoir Length.</u> (miles)	
	Normal pool	0.21
	Maximum pool	0.28
e.	<u>Storage.</u> (acre-feet)	
	Normal pool	16
	Maximum pool	114
f.	<u>Reservoir Surface.</u> (acres)	
	Normal pool	7
	Maximum pool	10
g.	<u>Dam.</u>	
	<u>Type</u>	Earthfill with a dry stone masonry downstream section.
	<u>Length</u> (feet)	255
	<u>Height</u> (feet)	26
	<u>Topwidth</u> (feet)	13

- |    |   |  |
|----|---|--|
| g. | <u>Dam. (cont'd.)</u><br><u>Side Slopes</u><br>Upstream<br>Downstream<br>Above El. 898.0<br>Below El. 898.0 | 1V on 1.9H<br><br>1V on 2.75H<br>near<br>vertical<br>(8-foot wide<br>berm at<br>El. 890) |
|    | <u>Zoning</u>   | Unknown  |
|    | <u>Cut-off</u>  | Unknown  |
|    | <u>Grout Curtain</u>  | None.  |
| h. | <u>Diversion and Regulating Tunnel.</u>   | None.  |
| i. | <u>Spillway.</u>  | Gorge re-<br>sulting<br>from failure<br>of spillway<br>structure<br>(See<br>Section 3.)  |
| j. | <u>Regulating Outlets.</u>  | Unknown,<br>conflicting<br>data<br>(See<br>Section 5.)                                   |

SECTION 2  
ENGINEERING DATA

2.1 Design.

a. Data Available. No design data pertinent to existing conditions are available for review.

b. Design Features. The project is described in Paragraph 1.2a. The various features of the dam are shown on the Photographs in Appendix C and on Plates E-2 and E-3 in Appendix E. Plate E-2 shows the existing dam as well as some features of a proposed modification, which was never constructed. The embankment is shown on Photographs A through D. The spillway is shown on Photographs F through H. The outlet works is shown on Photograph E.

c. Design Considerations. There is insufficient data to assess the design.

2.2 Construction.

a. Data Available. Limited construction data is available for review. The only available construction data that is pertinent concerns the 1884 modification to the dam. The data was collected by the Pennsylvania Water Supply Commission in 1914 for their report on the dam. The data states that earthfill used for the 1884 modification was clay borrowed from the reservoir area, that the dry stone masonry was sandstone taken from the adjacent hillside, and that shale riprap was placed on the upstream slope. The shale riprap had deteriorated to clay by 1914.

b. Construction Considerations. There is insufficient data to assess the construction of the dam.

2.3 Operation. There are no formal records of operation. A record of operation does exist in the form of inspection reports prepared by the Commonwealth between 1914 and 1964 as well as inspection reports prepared by the Owner. The findings of these previous inspections are discussed in other applicable sections of this Report.



## 2.4 Evaluation.

a. Availability. Engineering data were provided by the Bureau of Dams and Waterway Management, Department of Environmental Resources, Commonwealth of Pennsylvania (PennDER) and by Pennsylvania Gas and Water Company. The Owner made available an engineer for information. He also researched his files for information at the request of the inspection team.

b. Adequacy. The type and amount of available design data and other engineering data are very limited, and the assessment must be based on the combination of available data, visual inspection, performance history, hydrologic assumptions, and hydraulic assumptions.

c. Validity. There is no reason to question the validity of the available data. However, some of the data are in conflict, as noted hereafter.

SECTION 3  
VISUAL INSPECTION

3.1 Findings.

a. General. The overall appearance of the dam is fair. Deficiencies were observed as noted below. A sketch of the dam with the locations of deficiencies is presented in Exhibit B-1 in Appendix B. Survey information acquired for this Report is summarized in Appendix B. On the day of the inspection, the pool was at its normal level. Datum for the survey was taken at the top of the dry stone masonry section of the embankment.

b. Embankment. The term embankment used herein refers to both the dry stone masonry downstream section and the upstream earthfill. The upstream earthfill is covered with brush and trees of varying size (Photograph B). A few burrowing animal holes were observed in the slope. Some eroded areas, typically about 3 feet above normal pool, are on the slope. The eroded areas are narrow and about 1.5 feet high. The cause of the erosion was not evident; it did not appear that wave action was the cause. The top of the dam, which is earthfill, is irregular. The section is sketched in Appendix B.

The dry stone masonry downstream section has trees growing in and near the face (Photographs C, D, and E). The face is in good condition except for a bulge near the left abutment (Photograph D). The bulge protrudes a maximum of about 5 feet beyond the normal batter of the slope. The bulged area is about 50 feet long. In this area, the top of the dry stone masonry is a maximum of 2 feet lower than the adjacent sections.

Just to the left of the outlet works structure, at the toe of the dam, there is a soft area about 3 feet wide and 32 feet long. The old streambed is soft immediately downstream of the dam. Seepage estimated at 0.1 gpm was observed just to the right of the outlet works structure.

The survey performed for this inspection reveals that the top of the dam is uneven. The surveyed section reveals that the existing section approximately matches previous descriptions of the dam.

c. Appurtenant Structures. The outlet works structure looks like a pile of rubble (Photograph E). It is uncertain whether the present structure is the remains of a gate house or whether the structure was originally a dry stone masonry slab. A valve riser pipe extends through the top of the structure. It is believed that the riser pipe connects to the valve for the 8-inch diameter cast-iron pipe (CIP) that was observed extending downstream. This pipe is used for water supply. No emergency drawdown pipe was observed at the dam.

The existing spillway, which is about 400 feet to the right of the embankment, is shown on Plate E-3, which was drawn from survey data obtained during the visual inspection. It is also shown on Photographs F, G, and H. The spillway is a gorge that was eroded when the spillway structure washed out in 1955. The remains of the timber spillway structure are still within the gorge. There is some brush growing downstream of the timber structure on the banks of the gorge. A short reach of swamp separates the gorge from the reservoir. The reservoir just upstream of the swamp is very shallow.

d. Reservoir Area. The watershed is entirely wooded and undeveloped. Slopes are steep and some rock outcrops are evident.

e. Downstream Channel. Wanamie Run extends downstream from the dam in a very steep and narrow valley. The streambed is bedrock throughout most of this reach. The steep and narrow valley extends for 0.5 mile before widening. The right side of the valley has been strip mined. Within this reach is Wanamie Intake Dam, which is abandoned. Wanamie Intake Dam is a stone masonry dam that is estimated to contain about 1 acre-foot at normal pool. Normal pool is about 1 foot below the top of the dam.

Beyond the steep valley, Wanamie Run extends for about 0.2 mile through a relatively flat strip-mined area to the confluence with South Branch, Newport Creek. Near the confluence are 6 dwellings and a large commercial garage adjacent to the stream. There are also some abandoned structures in this area.

## SECTION 4

### OPERATIONAL PROCEDURES

4.1 Procedure. The reservoir is maintained at normal pool level with excess inflow discharging over the spillway and into the downstream channel. There is no functional outlet works at the dam.

4.2 Maintenance of Dam. No caretaker is assigned to the dam. The dam is visited infrequently and is not maintained.

4.3 Maintenance of Operating Facilities. There are no functional emergency drawdown facilities at the dam.

4.4 Warning Systems in Effect. The Owner has a generalized emergency warning system for dams within his system. It is not felt that the warning system would be effective because no caretaker is assigned to the dam.

4.5 Evaluation of Operational Adequacy. The maintenance of the dam is inadequate. Inspections are necessary to detect hazardous conditions at the dam. An emergency operation and warning system is necessary to reduce the risk of dam failure should adverse conditions develop, and to prevent loss of life should the dam fail.

## SECTION 5

### HYDROLOGY AND HYDRAULICS

#### 5.1 Evaluation of Features.

a. Design Data. There are no design data pertinent to the existing conditions.

b. Experience Data. The flood of record is the storm of August 1955, when the spillway washed out. There are no data to estimate the flow for this storm.

c. Visual Observations.

(1) General. The visual inspection of Wanamie Dam, which is described in Section 3, resulted in a number of observations relevant to hydrology and hydraulics. These observations are evaluated herein for the various features.

(2) Embankment. Data in the Owner's files indicate that, for the design condition, normal pool was at Elevation 897.6 and the design top of dam elevation was at 900.5. Some areas at the top of the dam are below this elevation. It is not felt that these low areas are significant for the present condition.

(3) Appurtenant Structures. The remains of the timber structure in the spillway gorge reduce the discharge capacity of the gorge. It is not felt that the brush downstream of the timber structure will have a significant effect on the hydraulics of the area. If it is allowed to grow thicker, it would begin to affect the hydraulics. Because the deep part of the reservoir is far away from the gorge, additional erosion of the gorge would not allow the sudden release of water stored in the impoundment.

There are no functional emergency drawdown facilities at the dam. The size and number of pipes beneath the embankment are unknown. The Pennsylvania Water Supply Commission Report indicates that there was a 10-inch diameter emergency drawdown pipe at the dam in 1914. Data in the Owner's files indicate that a 14-inch diameter CIP extends beneath the embankment and connects to the 8-inch diameter CIP water supply pipe and to a

4-inch diameter emergency drawdown outlet. There are no upstream closure facilities. The Owner does have various size plugs and an in-house diving capability to provide upstream closure for other dams within his system. This would be an adequate means of providing upstream closure if the size of the pipes beneath the embankment were known and proper size plugs were available.

(4) Reservoir Area. No conditions were observed in the reservoir area that might present a hazard to the dam. The drainage area of 1.08 square miles that is used in this Report is taken from recent USGS mapping. The drainage area of 0.77 square mile in the records was apparently taken from 1914 mapping. The reservoir storage figures used in this Report were taken from data obtained from USGS mapping and from Plate E-2.

(5) Downstream Conditions. A failure of the dam would cause flooding at a commercial garage and at least 6 dwellings with the potential for loss of life. Downstream conditions indicate that a high hazard classification is warranted for Wanamie Dam.

(d) Overtopping Potential.

(1) Spillway Design Flood. According to the criteria established by the Office of the Chief of Engineers (OCE), the Spillway Design Flood (SDF) for the size (Small) and hazard potential (High) of Wanamie Dam is between the Probable Maximum Flood (PMF) and 1/2 the PMF. Because of the downstream conditions, the PMF is selected as the SDF for Wanamie Dam. The watershed was modeled with the HEC-1DB computer program. A description of the model is included in Appendix D. The hydrologic and hydraulic assessment of the dam is based on existing conditions and the effects of future development are not considered. The assessment is also based on the Owner's present intention of not returning the dam to full service or to its original design condition.

(2) Summary of Results. Pertinent results are tabulated at the end of Appendix D. The analysis reveals that Wanamie Dam can pass the PMF with 7.9 feet of freeboard. The dam is rated at its existing top elevation. The analysis was performed with the assumption that the timber structure in the spillway had been removed.

(3) Spillway Adequacy. The criteria used to rate the spillway adequacy of a dam are described in Appendix D. Because the dam can pass the PMF, the spillway capacity is rated as adequate. This rating is dependent on the removal of the timber structure in the spillway.

## SECTION 6

### STRUCTURAL STABILITY

#### 6.1 Evaluation of Structural Stability

##### a. Visual Observations.

(1) General. The visual inspection of Wanamie Dam, which is described in Section 3, resulted in a number of observations relevant to structural stability. These observations are evaluated herein for the various features.

(2) Embankment. The eroded areas on the upstream slope of the dam are not a serious hazard at present, but continued erosion is possible. These areas may have started to erode because of foot traffic on the slope. Although riprap does not extend to the top of the dam, there were no areas of erosion due to wave action. Vegetation has apparently provided adequate slope protection.

The growth of trees and brush on the upstream slope and by the dry stone masonry downstream section is a hazard to the dam. Root systems can loosen embankment material, displace slope protection and dry stone masonry, and create paths along which seepage and piping (internal erosion) might occur. The large size of some of the trees that were observed increases the hazard potential. The burrowing animal holes observed on the upstream slope are of minor concern.

The seepage area and the swampy areas located along the toe of the dam near the right abutment appear to be similar in character and extent to conditions described in previous inspections since about 1919. Because of the similarity to previously described conditions and because of the small quantity of seepage, the seepage area and swampy areas do not appear to be of a serious nature at the present time.

The bulge along the dry stone masonry is of concern. In 1928, an inspector from the Commonwealth first noted a slight bulge in the area. It is not noted in four subsequent inspection reports prepared by the Commonwealth. In September 1953, inspectors from the



Owner's staff noted the bulge, which was described as protruding 5 feet and extending for 10 feet. They claimed that the bulge had appeared since their last inspection in March of the same year. It is felt that their description of the bulge matches the conditions observed during the visual inspection for this Report. The protrusion is pronounced for about 10 feet and more subtle for the remaining 40 feet. The bulge is assessed further in Paragraph 6.1c.

(3) Appurtenant Structures. The spillway and outlet works are assessed in Section 5.

b. Design and Construction Data. There are almost no design and construction data. Plate E-2 indicates that the dry stone masonry is solely a facing on the embankment. However, this plate was drawn from survey information obtained in 1933 and later. Both from descriptions of the dam and from impressions during the visual inspection, it is felt that the dry stone masonry is a gravity section. Except for its exposed face, nothing is known about its dimensions. The foundation conditions are also unknown.

c. Operating Records. There are no formal records of operation. The available data indicate that the embankment has performed satisfactorily for 96 years, with the exception of the bulge. The normal pool for the existing condition is 8.8 feet below the normal pool that was maintained for 71 years, during which time the bulge developed. The analysis described in Section 5 indicates that, during the PMF, the pool would only rise to an elevation that is 5.2 feet below the normal pool that was maintained satisfactorily for 71 years. It is felt that the stability of the embankment is adequate for the existing condition if no further movement of the bulge occurs. Frequent visual inspections and frequent monitoring of the bulge should provide sufficient time to take appropriate action if movement occurs.

d. Post-construction Changes. The post-construction changes were assessed previously.

e. Seismic Stability. Wanamie Dam is located in Seismic Zone 1. Earthquake loadings are usually assumed to occur with the reservoir at normal pool. Since the storage of Wanamie Dam at normal pool is only 16 acre-feet, failure during an earthquake would not result in any

significant flooding downstream. Since there is no hazard downstream due to failure resulting from an earthquake, the seismic stability of Wanamie Dam, for the existing condition, is deemed adequate.

SECTION 7  
ASSESSMENT, RECOMMENDATIONS, AND PROPOSED REMEDIAL  
MEASURES

7.1 Dam Assessment.

a. Safety.

(1) Based on available records, visual inspection, calculations, past operational performance, and consideration of the existing normal pool level, Wanamie Dam is judged to be in fair condition. The existing spillway is a gorge that was eroded when the spillway washed out in 1955. The spillway can pass the PMF, which is the Spillway Design Flood (SDF), with 7.9 feet of freeboard. Based on the size and hazard classification of the dam, the recommended SDF varies between the 1/2 PMF and the PMF. The selected SDF is based on the criteria and the downstream conditions. The pool level at maximum PMF level is 5.2 feet below the normal pool level that existed prior to 1955. The spillway capacity is rated as adequate. This rating is dependent upon removal of the remains of the timber structure in the spillway.

(2) The only significant stability problem noted for the embankment is a bulge near the left abutment of the embankment.

(3) The Owner presently has no intention of returning the dam to its design condition because there is no present requirement for increased water supply storage at the dam.

(4) There are no functional emergency drawdown facilities at the dam.

(5) Maintenance of the dam is inadequate.

(6) A summary of the features and observed deficiencies is listed below:

Feature and Location

Observed Deficiency

Embankment:

Trees and brush growing on and near earthfill and dry stone masonry; burrowing animal holes; minor erosion on upstream slope; minor seepage, bulge.

Spillway:

Remains of timber structure in spillway area; minor brush.

Outlet Works:

No operational emergency drawdown facilities; uncertain provisions for upstream closure.

b. Adequacy of Information. The information available is such that a preliminary assessment of the condition of the dam can be inferred from the combination of visual inspection, past performance, and computations performed prior to and as part of this study.

c. Urgency. The recommendations in Paragraph 7.2 should be implemented immediately.

d. Necessity for Further Investigations. In order to accomplish some of the remedial measures outlined in Paragraph 7.2, further investigations by the Owner will be required.

7.2 Recommendations and Remedial Measures.

a. The following investigations and remedial measures are recommended to be undertaken by the Owner, in approximate order of priority, immediately:

(1) Remove the remains of the timber structure from the spillway.

(2) Remove trees and brush on and near the embankment. Upon removal of brush and trees, the embankment should be inspected for bulges, cracks, and other signs of distress. Take appropriate action as required.

(3) Institute a monitoring program at the dam, such that the bulge is monitored with survey instruments or other monitoring equipment. If further movement is noted, provide remedial measures.

(4) Provide operational emergency drawdown facilities at the dam and ensure that there are provisions for upstream closure of all pipes through the embankment.

(5) As part of the maintenance and inspection programs recommended below, fill burrowing animal holes and visually monitor seepage, the brush in the spillway, and the minor erosion on the earthfill.

All investigations and monitoring programs should be supervised by a professional engineer experienced in the design and construction of dams. Tree removal should be performed under the guidance of a professional engineer.

b. In addition, the Owner should institute the following operational and maintenance procedures:

(1) Develop a detailed emergency operation and warning system for Wanamie Dam.

(2) During periods of unusually heavy rains, provide round-the-clock surveillance of Wanamie Dam.

(3) When warnings of a storm of major proportions are given by the National Weather Service, the Owner should activate his emergency operation and warning system.

(4) Institute an inspection program such that the dam is visited frequently. As presently required by the Commonwealth, the inspection program should include a formal annual inspection by a professional engineer experienced in the design and construction of dams. Utilized the inspection results to determine if remedial measures are necessary.

(5) Institute a maintenance program so that all features of the dam are properly maintained.

c. Should the Owner change his intentions and decide to return the dam closer to the design condition,

such that the existing normal pool condition is raised, then the internal dimensions of the dry stone masonry, the foundation conditions, and the zoning of the earthfill should be investigated and stability analyses performed.

APPENDIX A

CHECKLIST - ENGINEERING DATA

## CHECKLIST

NAME OF DAM: WANAMIE

## ENGINEERING DATA

NDI ID NO.: PA-00552 DER ID NO.: 40-21DESIGN, CONSTRUCTION, AND OPERATION  
PHASE ISheet 1 of 4

ITEM	REMARKS
AS-BUILT DRAWINGS	NONE
REGIONAL VICINITY MAP	SEE PLATE E-1
CONSTRUCTION HISTORY	BUILT CIRCA 1850 RAISED 1884 SPILLWAY WASHED OUT AND REPAIRED - 1923 SPILLWAY WASHED OUT - 1955
TYPICAL SECTIONS OF DAM	SEE PLATE E-2
OUTLETS: Plan Details Constraints Discharge Ratings	NONE



## ENGINEERING DATA

Sheet 2 of 4

ITEM	REMARKS
RAINFALL/RESERVOIR RECORDS	NONE
DESIGN REPORTS	NONE
GEOLOGY REPORTS	NONE
DESIGN COMPUTATIONS: Hydrology and Hydraulics Dam Stability Seepage Studies	NO DATA PERTINENT TO EXISTING CONDITIONS
MATERIALS INVESTIGATIONS: Boring Records Laboratory Field	NONE
POSTCONSTRUCTION SURVEYS OF DAM	SEE PLATE E-2

A-2

ENGINEERING DATA

ITEM	REMARKS
BORROW SOURCES	1884 MODIFICATION EARTHFILL - RESERVOIR AREA DRY MASONRY - ADJACENT HILLSIDE
MONITORING SYSTEMS	NONE
MODIFICATIONS	1884 - RAISED & DRY MASONRY ADDED.
HIGH POOL RECORDS	Believed to be Aug 1955 No pool data
POSTCONSTRUCTION ENGINEERING STUDIES AND REPORTS	SEE PLATE E-2
PRIOR ACCIDENTS OR FAILURE OF DAM: Description Reports	Spillway washed out & REPAIRED - 1933 Report by Thomas A. Wiggin Spillway washed out - 1955 Report by Thomas A. Wiggin

## ENGINEERING DATA

Sheet 4 of 4

ITEM	REMARKS
MAINTENANCE AND OPERATION RECORDS	None
SPILLWAY: Plan Sections Details	FOR EXISTING CONDITIONS SEE PLATE E-3.
OPERATING EQUIPMENT: Plans Details	None
PREVIOUS INSPECTIONS Dates Deficiencies  DATA CONCERNING SPILLWAY PRIOR TO 1955 is omitted. Inspections by PENNSYLVANIA WATER SUPPLY COMMISSION EXCEPT AS NOTED.	1914 - TREES ON EMBANKMENT. 1919 - SLIGHT LEAKAGE THROUGH BASE, POOR MAINTENANCE - MUCH VEGETATION. 1924 - OUTLET LEAKING, WET AT TOE, BRUSH AND TREES CONSIDERABLE LEAKAGE." 1928 - TOP OF "MAIN EMBANKMENT" IS LOW STARTING AT A POINT ABOUT 50' FROM LEFT END. SLIGHT BULGE TO LEFT OF HEAVY DRY MASONRY SECTION. BRUSH AND TREES. SLIGHT LEAK AT LEFT SIDE OF VALLEY AND TO RIGHT OF BLOW-OFF.
CONTINUED	

A-4

ENGINEERING DATA

ITEM	REMARKS
Previous Inspections (CONTINUED)	1932 - BRUSH AND TREES, SEEPAGE TOWARD LEFT END. 1934 - TOP OF DAM UNEVEN, SEEPAGE AT RIGHT END OF LOWER WALL-AT TOE, SMALL STREAM IN OLD CHANNEL NEAR OUTLET WORKS. SLIGHT SEEPAGE NEAR LEFT END.
	1943 - SLIGHT LEAKAGE 30' FROM RIGHT END COMING THROUGH CLAY STONE MASONRY WALL. ALSO SLIGHT LEAKAGE COMING THROUGH WALL 70' FROM LEFT END, WET AREA IMMEDIATELY TO RIGHT OF GATES AT TOE OF WALL.
	1953 (by PGW) BULGE IN CLAY STONE MASONRY WALL - BULGE IS 10' LONG AND IS PUSHED OUT ABOUT 3' TH - BULGE DEVELOPED SINCE MARCH 1953 (INSPECTION WAS IN SEPTEMBER 1953).
	1964 - NOTED WASHED OUT SPILLWAY.

APPENDIX B

CHECKLIST - VISUAL INSPECTION

# CHECKLIST

## VISUAL INSPECTION

### PHASE I

Name of Dam: WANAMIE County: LUZERNE State: PENNSYLVANIA  
 NDI ID No.: PA-00552 DER ID No.: 40-21  
 Type of Dam: DRY MASONRY w/UPSTREAM EARTH FILL Hazard Category: HIGH  
 Date(s) Inspection: 25 October 1979 Weather: OVERCAST - Windy Temperature: 45°F

Soil Conditions: Moist

Pool Elevation at Time of Inspection: 888.8 msl/Tailwater at Time of Inspection: N/A msl

#### Inspection Personnel:


D. Wilson (GFCC)

D. Ebersole (GFCC)

A. WHITMAN (GFCC) Recorder

# EMBANKMENT UPSTREAM OF DRY MASONRY

Sheet 1 of 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	NONE	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	UPSTREAM TOE SUBMERGED	
SLOUGHING OR EROSION: Embankment Slopes Abutment Slopes	SURFACE EROSION ON UPSTREAM SLOPE. THESE AREAS ARE ABOUT 3' ABOVE NORMAL POOL	BURROWING ANIMAL HOLES IN SLOPE. ERODED AREAS ARE NARROW AND ABOUT 1.5' HIGH
CREST ALIGNMENT: Vertical Horizontal	VERTICAL - SEE SURVEY DATA FOLLOWING INSPECTION FORMS. EMBANKMENT AT TOP OF DAM IS ARCHED DOWNSTREAM	 <p>↑ 0.7' MAX FLOW</p> <p>TYPICAL EMBANKMENT SECTION</p>
RIPRAP FAILURES	NONE OBSERVED AT SITE.	

# EMBANKMENT

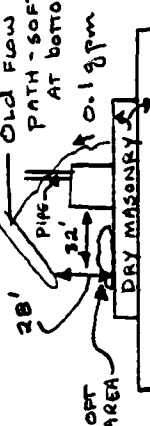
Sheet 2 of 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
FUNCTION OF EMBANKMENT WITH: Abutment Spillway Other Features	No deficiencies	
ANY NOTICEABLE SEEPAGE	Not applicable	
STAFF GAGE AND RECORDER	None	
DRAINS	None	
VEGETATION	SLOPE IS COVERED WITH TREES AND BRUSH - TREES 3" I DIA. EXCEPT NEAR RIGHT ABUTMENT 6" I DIA.	





# CONCRETE/MASONRY DAMS

Sheet 1 of 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	SEE SKETCH AT LEFT	
JUNCTION OF STRUCTURE WITH: Abutment Embankment Other Features	No DEFICIENCIES	
DRAINS	NONE	
WATER PASSAGES	8" CIP WATER supply PIPE EXTENDS DOWNSTREAM.	No EMERGENCY DRAWDOWN PIPE.
FOUNDATION	Not Visible	

# CONCRETE/MASONRY DAMS

Sheet 2 of 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SURFACES: Surface Cracks Spalling	NOT APPLICABLE	LARGE TREES NEAR TOE AND SMALLER TREES GROWING IN DRY MASONRY.
STRUCTURAL CRACKING	NONE	
ALIGNMENT: Vertical Horizontal	No deficiencies except bulge sketched below  LEFT ABUT.	PROFILE OF AREA AT LEFT EARTHFIILL  6" DIP (POOR CONSTRUCTION PRACTICES)
MONOLITH JOINTS	Dry Masonry	
CONSTRUCTION JOINTS	Dry Masonry	
STAFF GAGE OR RECORDER	NONE	

# OUTLET WORKS

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	NOT APPLICABLE	8" CIP WATER SUPPLY PIPE EXTENDS FROM TOE
INTAKE STRUCTURE	IF ANY, IT WAS SUBMERGED	
OUTLET STRUCTURE	NONE	
OUTLET CHANNEL	NONE	
EMERGENCY GATE	NONE	

# UNGATED SPILLWAY

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR		
APPROACH CHANNEL		
DISCHARGE CHANNEL		
BRIDGE AND PIERS		

# INSTRUMENTATION

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS		
OBSERVATION WELLS		
WEIRS	NONE AT SITE	
PIEZOMETERS		
OTHER		

# DOWNSTREAM CHANNEL

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION: Obstructions Debris Other	At dam site - No pertinent observations	ABOUT 1000' DOWNSTREAM WANAMIS INTAKE DAM - PARTIALLY BREACHED. IT IS SO SMALL THAT IT PRESENTS NO HAZARD TO ANYONE DOWNSTREAM
SLOPES	STEEP TO VERY STEEP	
APPROXIMATE NUMBER OF HOMES AND POPULATION	1 COMMERCIAL STRUCTURE AND 6 DWELLINGS NEAR CONFLUENCE WITH SOUTH BRANCH NEWPORT CREEK	SOME OTHER STRUCTURES ARE ABANDONED.

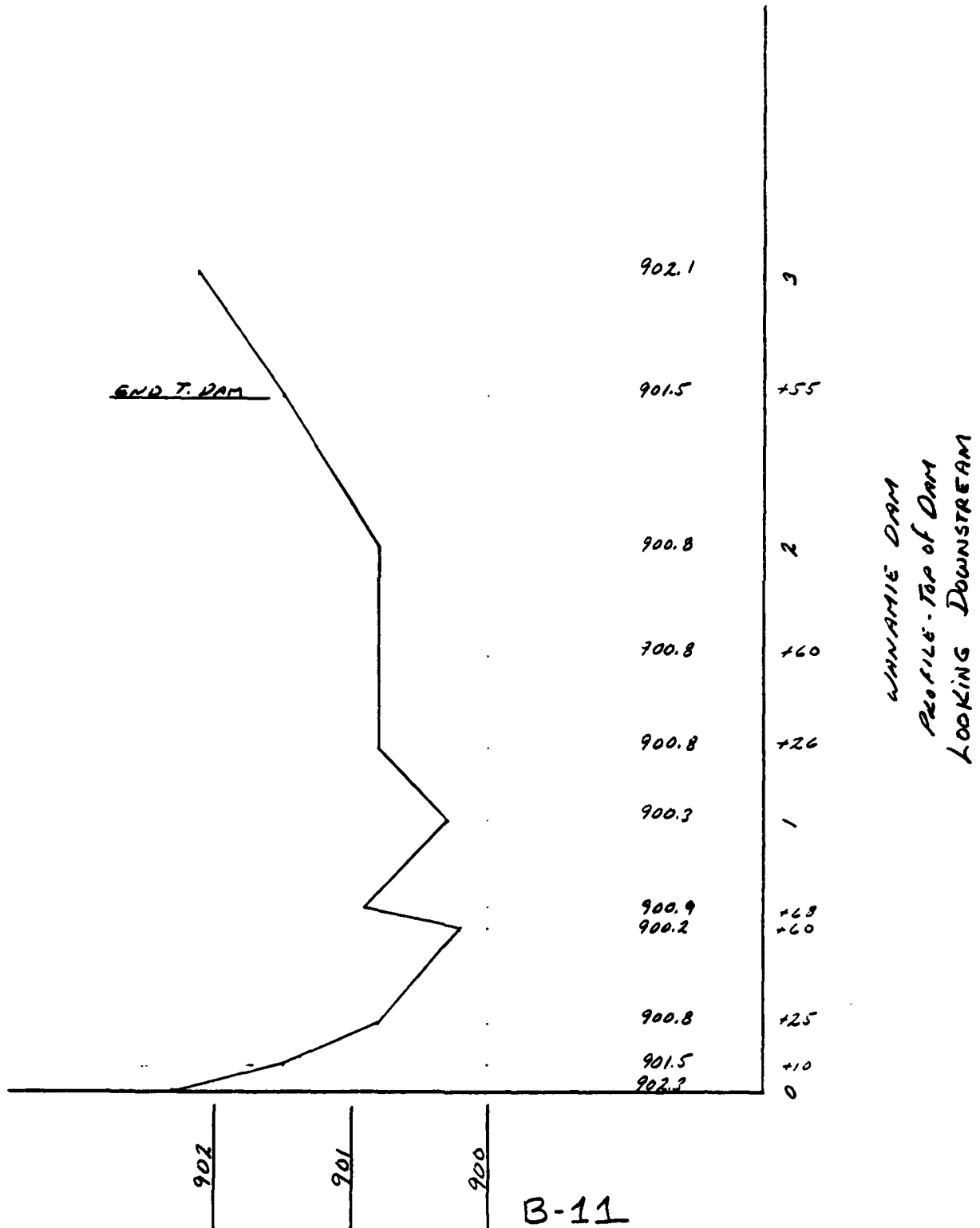
# RESERVOIR AND WATERSHED

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	STEEP	
SEDIMENTATION	COULD NOT be determined FROM VISUAL INSPECTION.	
WATERSHED DESCRIPTION	ENTIRELY UNDEVELOPED AND WOODED.	

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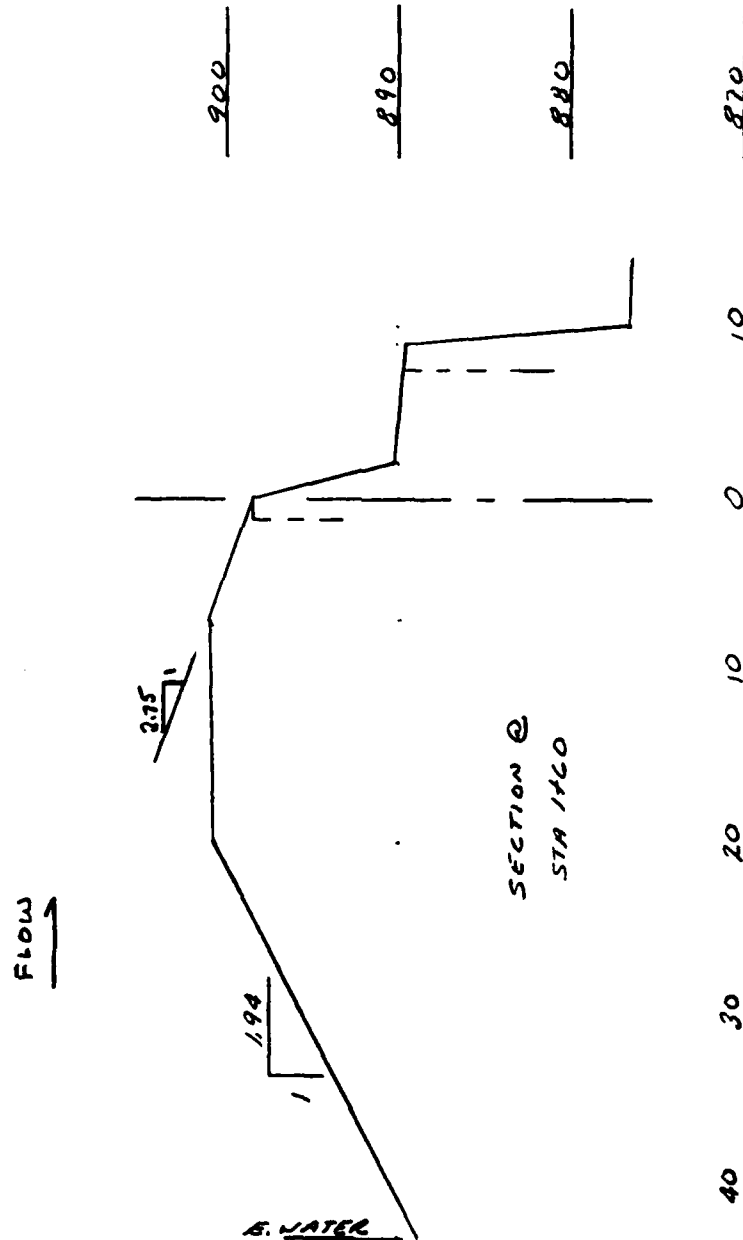
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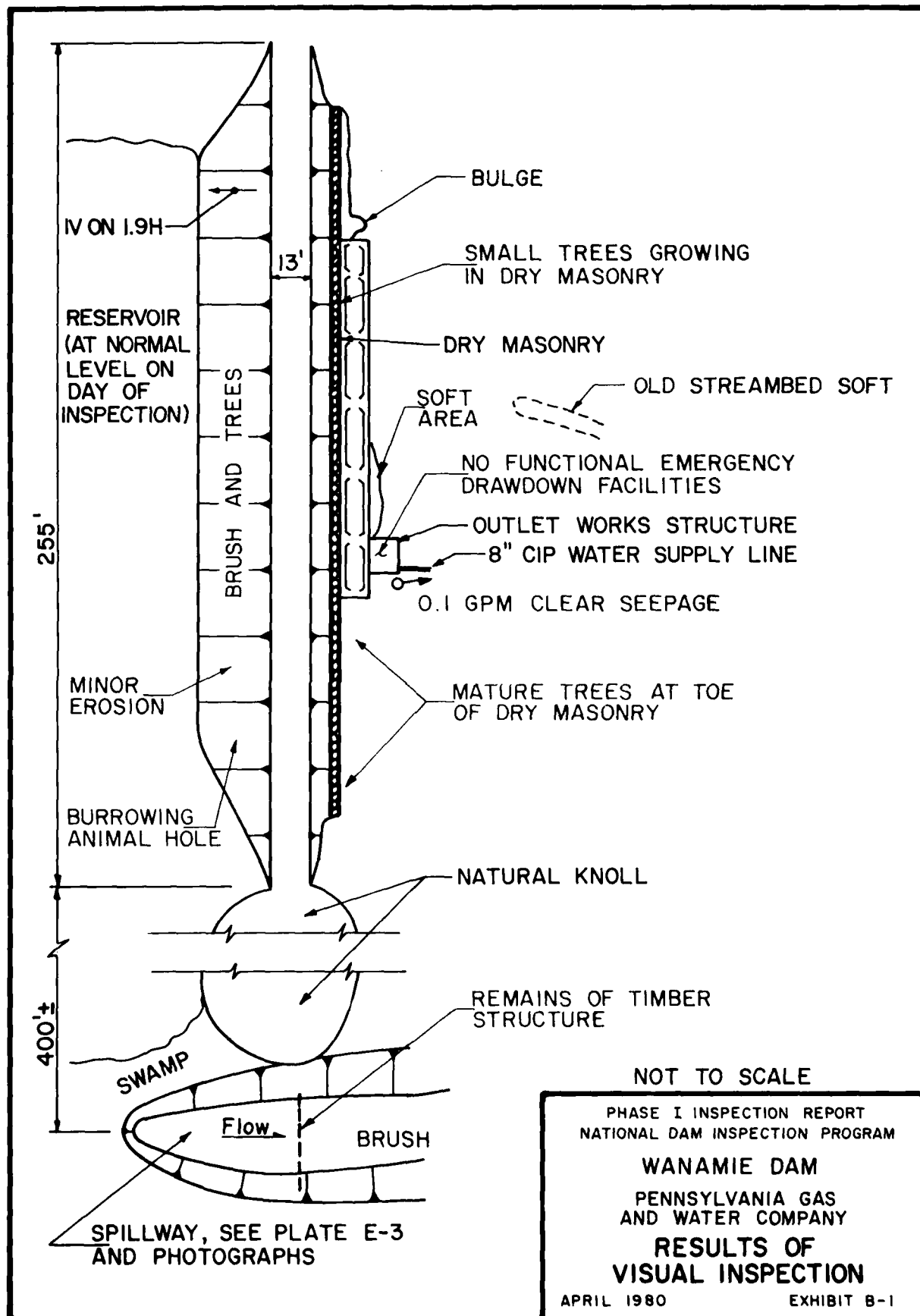


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B-12



APPENDIX C  
PHOTOGRAPHS

WANAMIE DAM



A. Top of Dam.



B. Upstream Slope.

WANAMIE DAM



C. Downstream Slope.

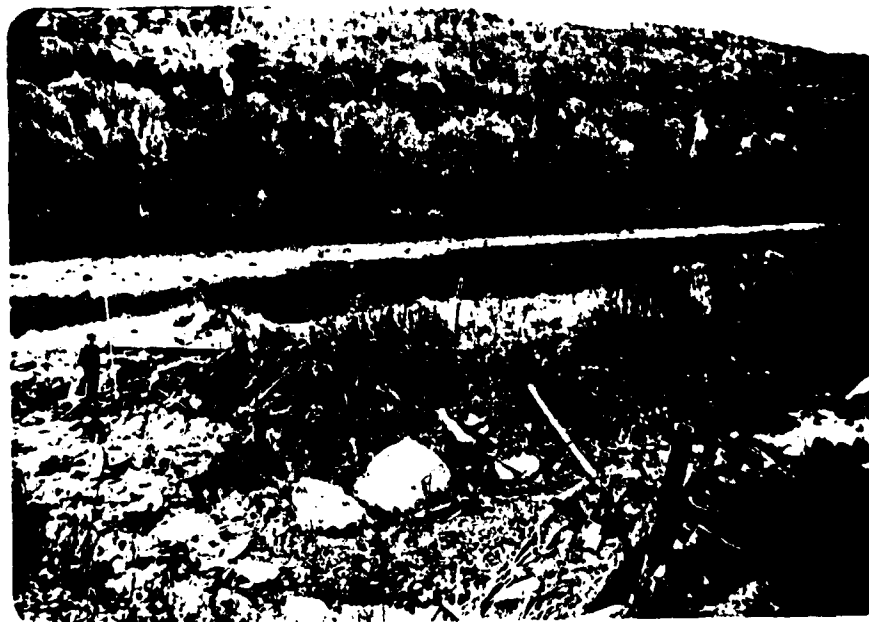


D. Bulge near Left Abutment.

WANAMIE DAM



E. Outlet Works Structure.



F. Spillway and Reservoir.

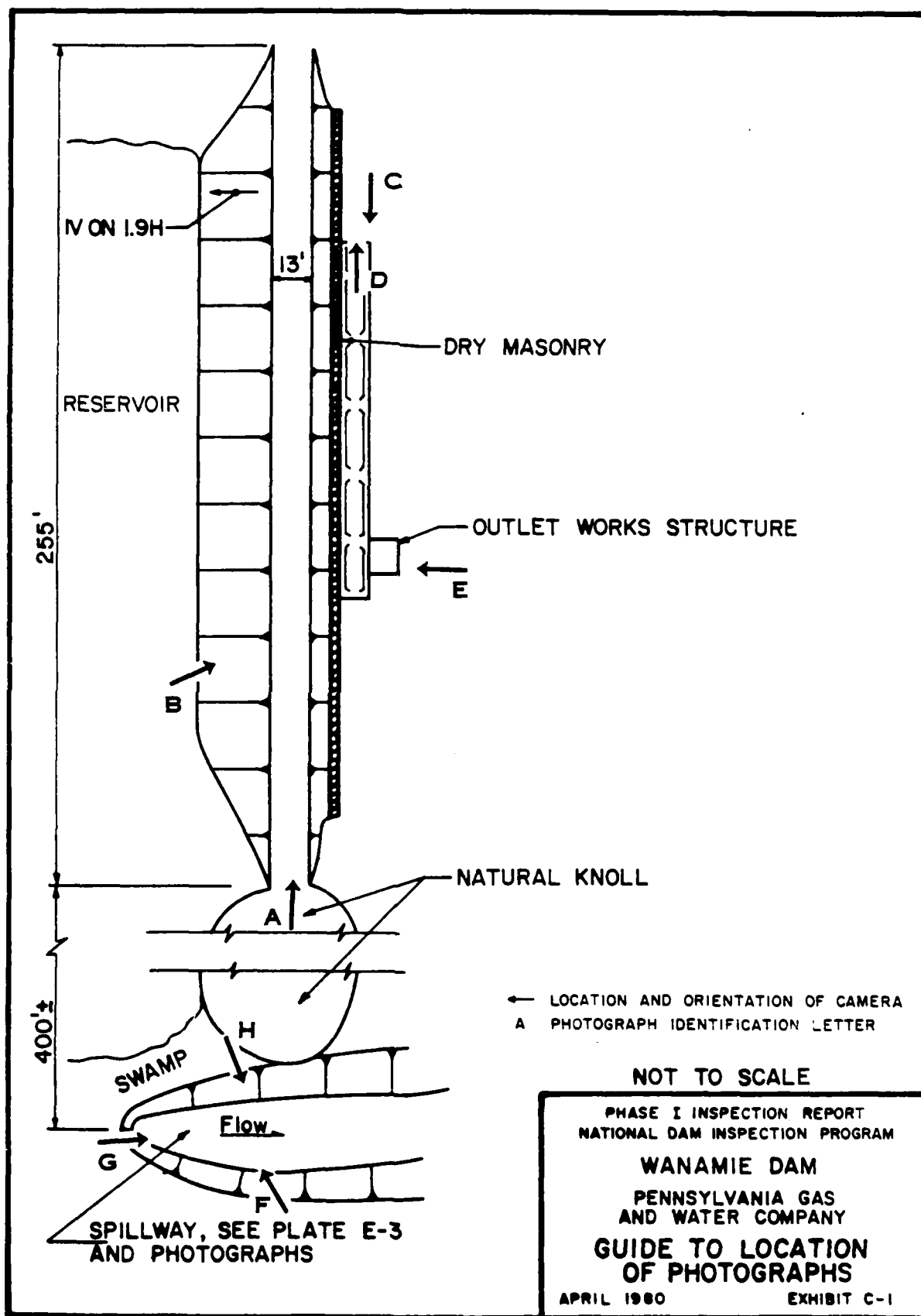
WANAMIE DAM



G. Spillway - Looking Downstream.



H. Spillway - Looking Downstream.





APPENDIX D  
HYDROLOGY AND HYDRAULICS

## APPENDIX D

### HYDROLOGY AND HYDRAULICS

#### Spillway Capacity Rating:

In the recommended Guidelines for Safety Inspection of Dams, the Department of the Army, Office of the Chief of Engineers (OCE), established criteria for rating the capacity of spillways. The recommended Spillway Design Flood (SDF) for the size (small, intermediate, or large) and hazard potential (low, significant, or high) classification of a dam is selected in accordance with the criteria. The SDF for those dams in the high hazard category varies between one-half of the Probable Maximum Flood (PMF) and the PMF. If the dam and spillway are not capable of passing the SDF without overtopping failure, the spillway capacity is rated as inadequate. If the dam and spillway are capable of passing one-half of the PMF without overtopping failure, or if the dam is not in the high hazard category, the spillway capacity is not rated as seriously inadequate. A spillway capacity is rated as seriously inadequate if all of the following conditions exist:

- (a) There is a high hazard to loss of life from large flows downstream of the dam.
- (b) Dam failure resulting from overtopping would significantly increase the hazard to loss of life downstream from the dam from that which would exist just before overtopping failure.
- (c) The dam and spillway are not capable of passing one-half of the PMF without overtopping failure.

#### Description of Model:

If the Owner has not developed a PMF for the dam, the watershed is modeled with the HEC-1DB computer program, which was developed by the U.S. Army Corps of Engineers. The HEC-1DB computer program calculates a PMF runoff hydrograph (and percentages thereof) and routes the flows through both reservoirs and stream sections. In addition, it has the capability to simulate an overtopping dam failure. By modifying the rainfall criteria, it is also possible to model the 100-year flood with the program.

# APPENDIX D

SUSQUEHANNA River Basin  
 Name of Stream: WANAMIE RUN  
 Name of Dam: WANAMIE  
 NDI ID No.: PA-00552  
 DER ID No.: 40-21  
 Latitude: N 41° 10' 00" Longitude: W 76° 01' 30"  
 Top of Dam Elevation: 900.2 (EXISTING)  
 Streambed Elevation: 876.6 Height of Dam: 24 ft  
 Reservoir Storage at Top of Dam Elevation: 114 acre-ft  
 Size Category: SMALL  
 Hazard Category: High (see Section 5)  
 Spillway Design Flood: VARIES PMF TO 1/2 PMF  
SELECT PMF

## UPSTREAM DAMS

Name	Distance from Dam (miles)	Height (ft)	Storage at top of Dam Elevation (acre-ft)	Remarks
<u>NONE</u>				

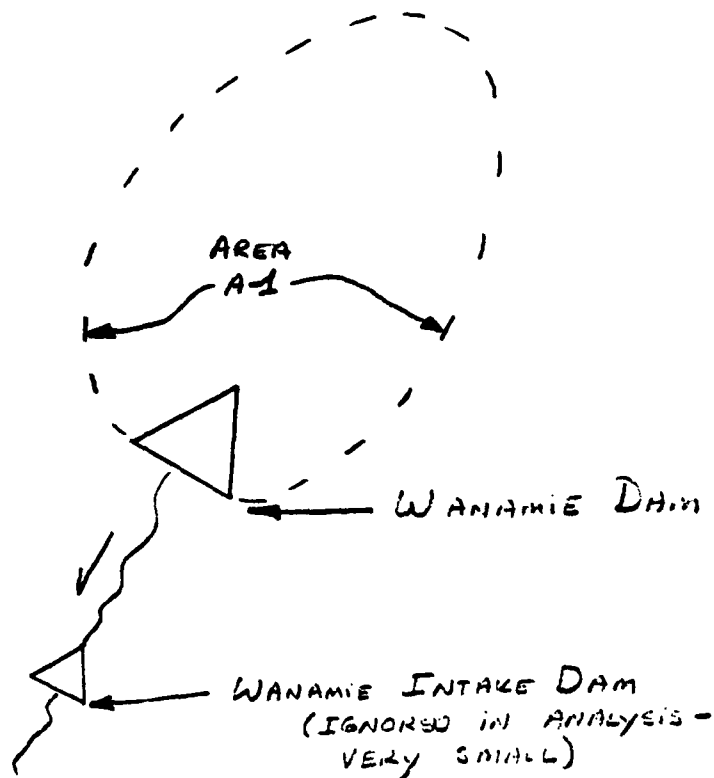
## DOWNSTREAM DAMS

<u>NONE</u>	<u>(VERY SMALL INTAKE DAM</u>			
	<u>DOWNSTREAM, WHICH WOULD</u>			
	<u>NOT AFFECT ANALYSIS).</u>			



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SKETCH  
OF  
SYSTEM

D-4

Data for Dam at Outlet of Subarea A-1 (See sketch on Sheet D-4)

Name of Dam: WANAMIE

STORAGE DATA:

Elevation	Area (acres)	Storage		Remarks
		million gals	acre-ft	
<u>882.0</u> = ELEV0*	<u>0</u>	<u>0</u>	<u>0</u>	<u>ELEVO FROM</u> <u>PLATE E-2</u>
<u>888.8</u> = ELEV1	<u>7</u> = A1		<u>16</u> = S1	
<u>900.2</u>	<u>10.4</u>		<u>114</u>	
<u>900.8</u>	<u>10.6</u>		<u>121</u>	
<u>920.0</u> **	<u>18</u>			

\* ~~ELEV0 - ELEV1~~ (351/A1)  $S_1 = (ELEV1 - ELEV0) \times A1/3$

\*\* Planimetered contour at least 10 feet above top of dam

Reservoir Area at Normal Pool is 1 percent of subarea watershed.

BREACH DATA: Not Used

See Appendix B for sections and existing profile of the dam.

Soil Type from Visual Inspection: \_\_\_\_\_

Maximum Permissible Velocity (Plate 28, EM 1110-2-1601) \_\_\_\_\_ fps  
(from  $Q = CLH^{3/2} = V \cdot A$  and depth =  $(2/3) \times H$ ) &  $A = L \cdot \text{depth}$

HMAX =  $(4/9 V^2/C^2)$  = \_\_\_\_\_ ft., C = \_\_\_\_\_ Top of Dam El. = \_\_\_\_\_

HMAX + Top of Dam El. = \_\_\_\_\_ = FAILEL  
(Above is elevation at which failure would start)

Dam Breach Data:

BRWID = \_\_\_\_\_ ft (width of bottom of breach)  
Z = \_\_\_\_\_ (side slopes of breach)  
ELBM = \_\_\_\_\_ (bottom of breach elevation, minimum of  
zero storage elevation)  
WSEL = \_\_\_\_\_ (normal pool elevation)  
T FAIL = \_\_\_\_\_ mins = \_\_\_\_\_ hrs (time for breach to  
develop)

Data for Dam at Outlet of Subarea A-1

Name of Dam: WANAMIE

SPILLWAY DATA:

	Existing Conditions	Design Conditions
Top of Dam Elevation	SEE FOLLOWING SHEETS	
Spillway Crest Elevation		
Spillway Head Available (ft)		
Type Spillway		
"C" Value - Spillway		
Crest Length - Spillway (ft)		
Spillway Peak Discharge (cfs)		
Auxiliary Spillway Crest Elev.		
Auxiliary Spill. Head Avail. (ft)		
Type Auxiliary Spillway		
"C" Value - Auxiliary Spill. (ft)		
Crest Length - Auxil. Spill. (ft)		
Auxiliary Spillway		
Peak Discharge (cfs)		
Combined Spillway Discharge (cfs)		

Spillway Rating Curve: SEE FOLLOWING SHEETS

Elevation	Q Spillway (cfs)	Q Auxiliary Spillway (cfs)	Combined (cfs)
888.8	0	N/A	N/A
890.0	1,190		
891.0	1,760		
892.0	2,250		
893.0	2,850		
894.0	3,600		
894.7	4,040		
897.5	5,836		
900.2	7,840		
903.0	10,033		

OUTLET WORKS RATING:

NONE AT SITE

	Outlet 1	Outlet 2	Outlet 3
Invert of Outlet	N/A	N/A	N/A
Invert of Inlet			
Type			
Diameter (ft) = D			
Length (ft) = L			
Area (sq. ft) = A			
N			
K Entrance			
K Exit			
K Friction = $29.1N^2L/R^{4/3}$			
Sum of K			
$(1/K)^{0.5} = C$			
Maximum Head (ft) = HM			
$Q = CA\sqrt{2g(HM)}$ (cfs)			
Q Combined (cfs)			

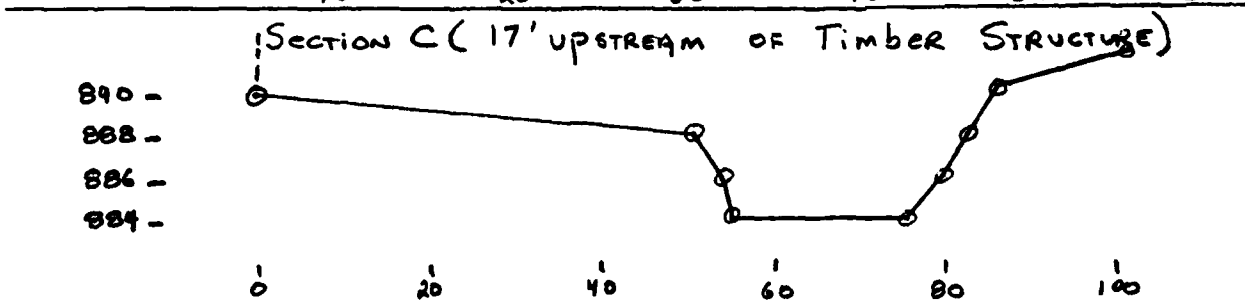
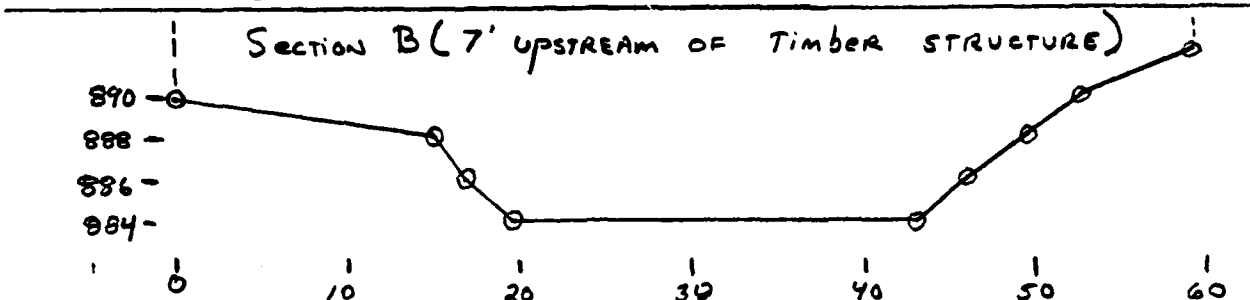
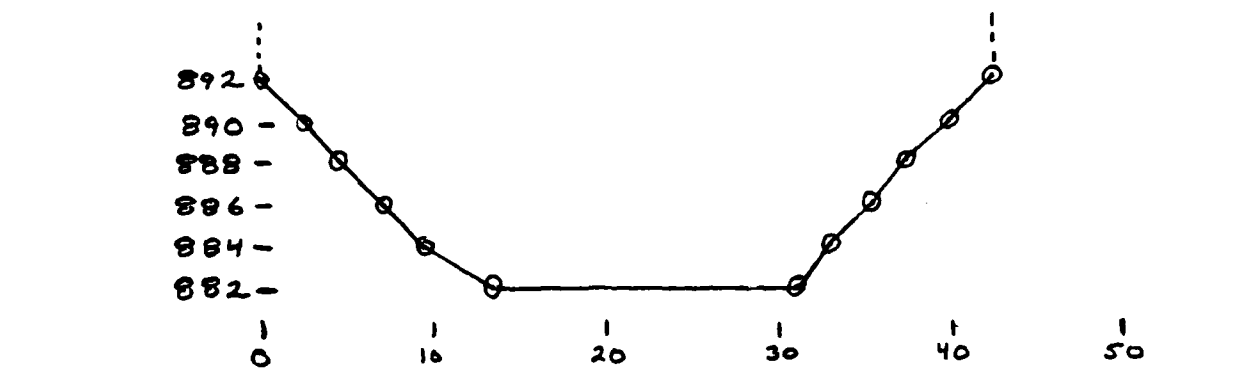
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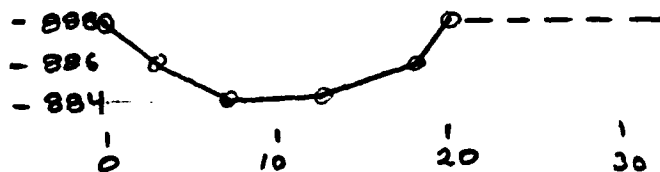
REFERENCE Spillway Plan  
PLATE E-3

SECTIONS LOOKING DOWNSTREAM

Section A (18' DOWNSTREAM OF TIMBER STRUCTURE):



Section D (42' upstream of Timber Structure)  
LOW FLOW CONTROL ONLY



D-7



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Method of computation  
(MODIFIED CRITICAL DEPTH)

$$Q = \frac{2.7}{3.1} \sqrt{\frac{A^3 g}{T}} \quad V = Q/A$$

$$h_v = V^2 / 2g$$

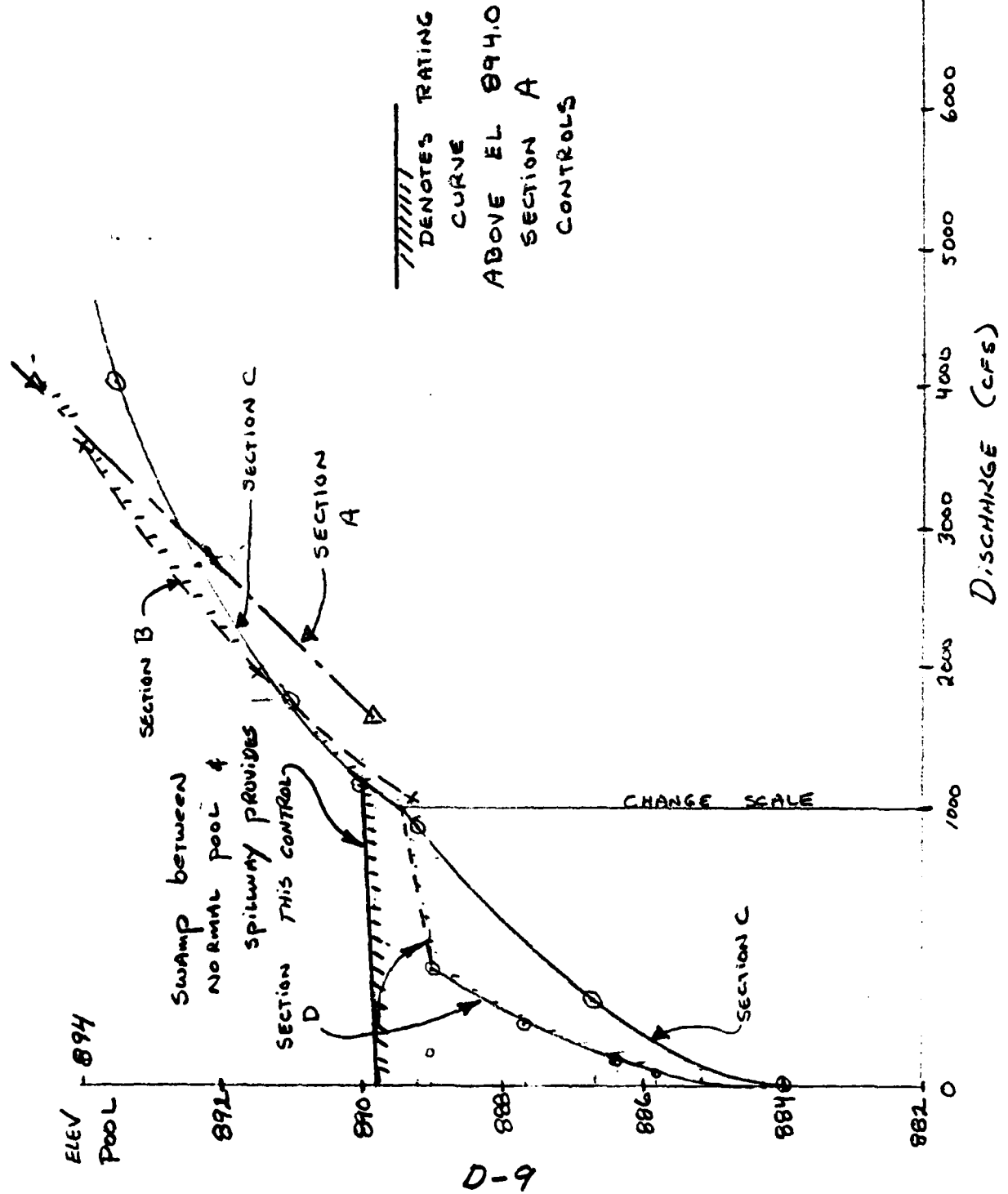
pool = W.S. elevation +  $h_v$

Computations by DESK CALCULATOR

	W.S. elevation	Q	Pool
SECTION D	884.3	0	884.3
	884.4	.3	884.4
	885.0	17	885.2
	885.5	46	885.8
	886.0	88	886.4
	887.0	225	887.7
	888.0	413	889.0
	884.0	0	884.0
SECTION C	886.0	305	886.7
	888.0	920	889.2
	889.0	1,162	890.0
	890.0	1,744	891.0
	892.0	4,042	893.5
SECTION B	884.0	0	884.0
	888.0	1,050	889.3
	890.0	1,973	891.5
	892.0	3,585	894.0
	894.0	5,780	896.8
	896.0	8,299	899.5
	898.0	11,104	902.3
SECTION A	882.0	0	882.0
	890.0	2,723	892.3
	892.0	4,040	894.7
	894.0	5,836	897.5
	896.0	7,840	900.2
	898.0	10,033	903.0
	888.0	1,652	889.8
		D-8	

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## SELECTED COMPUTER OUTPUT

ITEM

PAGE

### MULTI-RATIO ANALYSIS

Input	D-11
SUMMARY OF PEAK FLOWS	D-12
WANAMIE DAM	D-13

D-10

FLOOD HYDROGRAPH PACKAGE (NEC-1)  
 DAM SAFETY VERSION JULY 1978  
 LAST MODIFICATION 17 JAN 80

	NATIONAL DAM INSPECTION PROGRAM									
	VANAMIE RUN					VANAMIE DAM				
	A1	A2	A3	B	C	D	E	F	G	H
1	300	0	15	0	0	0	0	0	-4	0
2	1	2	1							
3	1	1	1							
4	1	1	1							
5	1	1	1							
6	1	1	1							
7	1	1	1							
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9	1	1	1							
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24	1	1	1							
25	1	1	1							
26	1	1	1							
27	1	1	1							

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS  
 FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)  
 AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS	
				RATIO 1	RATIO 2
				1.00	.50
HYDROGRAPH AT	1	1.08	1	2484.	1242.
	(	2.80)	(	70.33)	35.17)
ROUTED TO	1	1.08	1	2460.	1235.
	(	2.80)	(	69.66)	34.96)

D-12

SUMMARY OF DAM SAFETY ANALYSIS

WANAMIE DAM

PLAN 1 .....		INITIAL VALUE		SPILLWAY CREST		TOP OF DAM	
		898.80		889.80		900.20	
		16.		16.		115.	
		0.		0.		7840.	
ELEVATION		MAXIMUM		MAXIMUM		DURATION	
STORAGE		RESERVOIR		STORAGE		OVER TOP	
OUTFLOW		W.S.-ELEV		AC-FT		HOURS	
		892.35		42.		0.00	
		890.08		25.		0.00	
RATIO		MAXIMUM		MAXIMUM		TIME OF	
OF		DEPTH		OUTFLOW		MAX OUTFLOW	
PMF		OVER DAM		CFS		HOURS	
1.00		0.00		2460.		41.00	
.50		0.00		1235.		40.75	
						TIME OF	
						FAILURE	
						HOURS	
						0.00	
						0.00	

GANNETT FLEMING CORDRY  
AND CARPENTER, INC.  
HARRISBURG, PA.

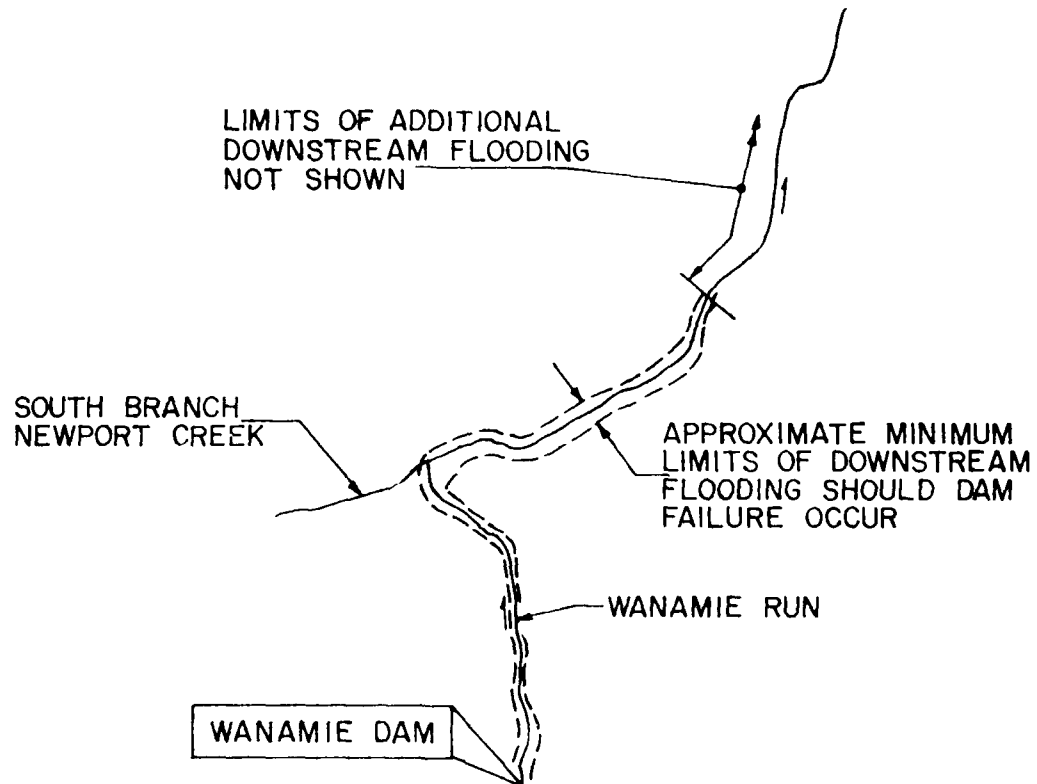
SUBJECT \_\_\_\_\_ FILE NO. \_\_\_\_\_  
SHEET NO. \_\_\_\_\_ OF \_\_\_\_\_ SHEETS  
FOR \_\_\_\_\_  
COMPUTED BY \_\_\_\_\_ DATE \_\_\_\_\_ CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

## SUMMARY OF PERTINENT RESULTS

PMF RAINFALL = 24.71"

	<u>PMF</u>	<u>1/2 PMF</u>
RUNOFF (INCHES)	22.15	11.08
PEAK INFLOW (CFS)	2484	1,242
PEAK OUTFLOW (CFS)	2460	1,235
FREEBOARD (FT)	7.85	10.12

D-14



**NOTES:**

1. LIMITS OF DOWNSTREAM FLOODING ARE ESTIMATES BASED ON VISUAL OBSERVATIONS.
2. CIRCLED NUMBERS INDICATE STATIONS USED IN COMPUTER ANALYSIS.
3. THIS MAP SHOULD NOT BE USED IN CONNECTION WITH THE EMERGENCY OPERATION AND WARNING PLAN.

2000 0 2000  
SCALE: 1 IN. = 2000 FT.

PHASE I INSPECTION REPORT  
NATIONAL DAM INSPECTION PROGRAM

**WANAMIE DAM**

PENNSYLVANIA GAS  
AND WATER COMPANY

**DOWNSTREAM  
DEVELOPMENT MAP**

APRIL 1980

EXHIBIT D-1



APPENDIX E

PLATES



COMMUNITY  
OF WANAMIE

SOUTH BRANCH  
NEWPORT CREEK

WANAMIE RUN

WANAMIE INTAKE DAM

WANAMIE DAM

THIS PAGE IS BEST QUALITY PRACTICABLE  
FROM COPY FURNISHED TO DDC

2000 0 2000

SCALE: 1 IN. = 2000 FT.

PHASE I INSPECTION REPORT  
NATIONAL DAM INSPECTION PROGRAM

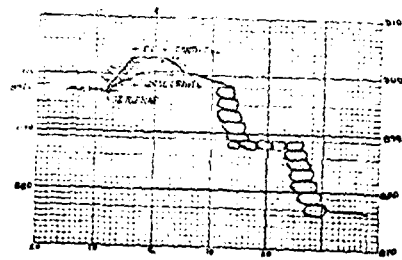
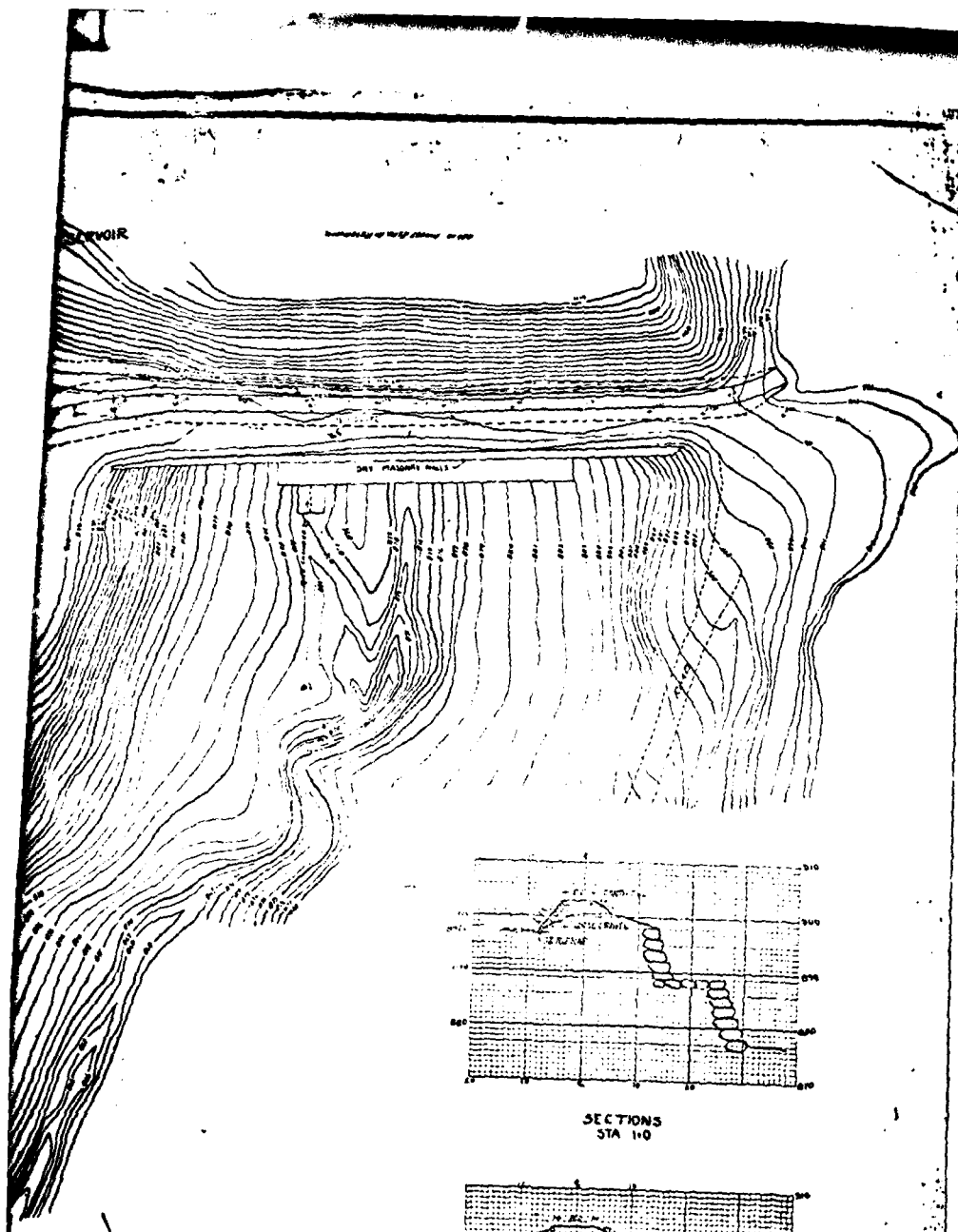
WANAMIE DAM  
PENNSYLVANIA GAS  
AND WATER COMPANY

LOCATION MAP

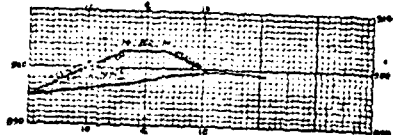
APRIL 1980

PLATE E-1





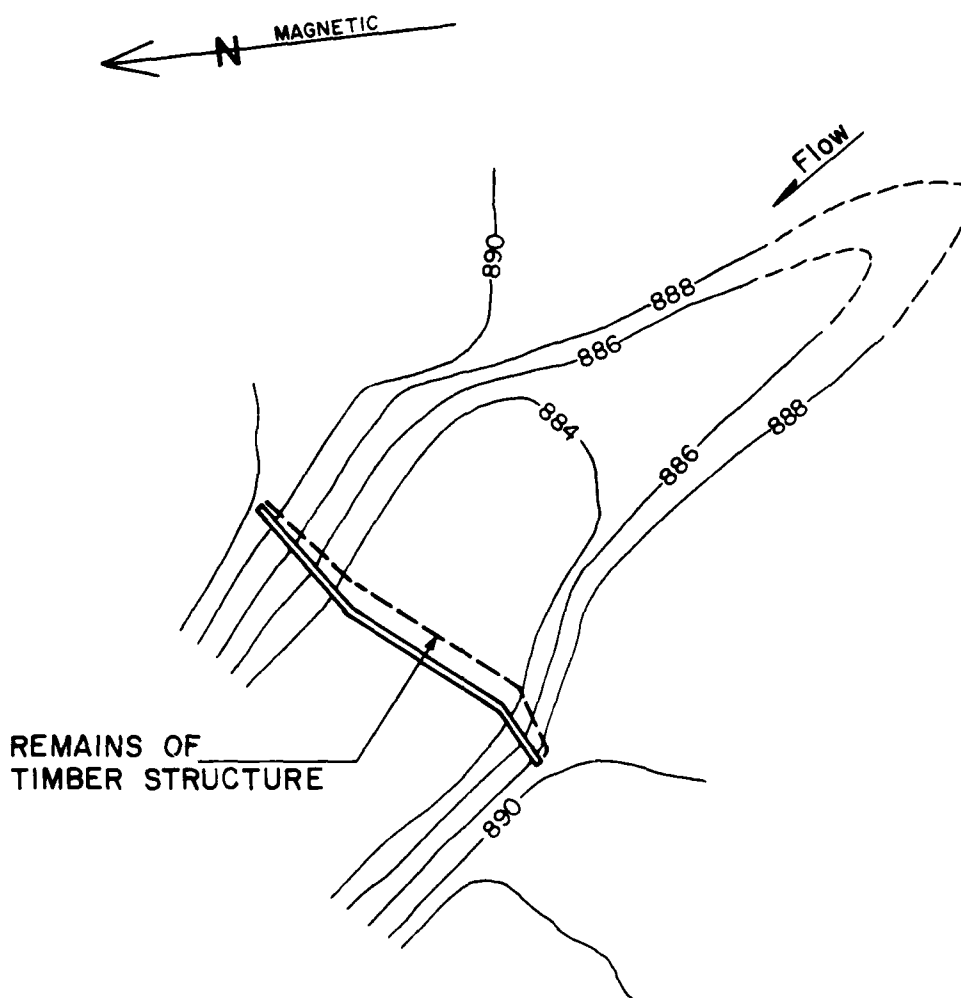
SECTIONS  
STA 1+0



STA 7+50

Continued from Plate E-1  
 1. Reservoir  
 2. Dam  
 3. Dry Drainage Ditch  
 4. Embankment  
 5. Foundation  
 6. Abutment  
 7. Spillway  
 8. Outlet  
 9. Foundation  
 10. Abutment  
 11. Spillway  
 12. Outlet  
 13. Foundation  
 14. Abutment  
 15. Spillway  
 16. Outlet  
 17. Foundation  
 18. Abutment  
 19. Spillway  
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 87. Spillway  
 88. Outlet  
 89. Foundation  
 90. Abutment  
 91. Spillway  
 92. Outlet  
 93. Foundation  
 94. Abutment  
 95. Spillway  
 96. Outlet  
 97. Foundation  
 98. Abutment  
 99. Spillway  
 100. Outlet

PHASE I INSPECTION REPORT  
 NATIONAL DAM INSPECTION PROGRAM  
 WANAMIE DAM  
 PENNSYLVANIA GAS  
 AND WATER COMPANY  
 PLAN OF EMBANKMENT  
 APRIL 1920 PLATE E-2



SCALE: 1 IN = 20 FT.



PHASE I INSPECTION REPORT  
NATIONAL DAM INSPECTION PROGRAM

WANAMIE DAM

PENNSYLVANIA GAS  
AND WATER COMPANY

PLAN OF  
EXISTING SPILLWAY

APRIL 1980

PLATE E-3

APPENDIX F

GEOLOGY

## WANAMIE DAM

### APPENDIX F

#### GEOLOGY

Wanamie Dam is located in Luzerne County and lies within the Valley and Ridge Province. The Lackawanna Syncline is the most important structural feature in this section of northeastern Pennsylvania. It is a broad canoe-shaped downwarp that trends northeast and southwest from Orson to Orangeville. The rim rocks are of the Pottsville and Pocono Formations; they have dips that are usually 20° or less and form a simple syncline. The core rock is of the Llewellyn Formation; it is folded into a series of minor anticlines and synclines that trend N 70° E. Rock to both the northwest and southeast of the Lackawanna Syncline is of the Appalachian Plateau Province and is usually horizontally-bedded.

Bedrock units of the Lackawanna Syncline are the lithified sediments of deltaic, fluvial, and swamp environments. The sediments are of the Mississippian and the Pennsylvanian Periods. The bedrock units include sandstones, conglomerates, and shales of the Pocono Formation; red shales of the Mauch Chunk Formation; and sandstones, conglomerates, shales, and coals of the Pottsville and Llewellyn Formations.

Although the geologic map shown on Exhibit F-1 indicates the dam to be in the Llewellyn Formation, more detailed unpublished geologic mapping by the Pennsylvania Geologic Survey indicates that the damsite is underlain by the Mississippian Mauch Chunk Formation. This formation, which is composed of shale and sandstone, is relatively soft. It forms a valley between the more resistant Pottsville and Pocono Formations. Strike usually runs in the approximate direction of the valley axis and the dip is usually northwest. The rocks in the Mauch Chunk Formation generally have low to medium primary porosity, but jointing provides a high effective porosity.

Although outcrop is evident upstream and downstream from the dam, none is evident at the damsite. The foundation of Wanamie Dam is unknown.





**DATE  
FILMED**

**6-8**